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COVID19 PCR Testing and the Unprecedented Institutional Response in a Low-Resource Setting

Akintunde Orunmuyi [1,*], Olukemi Adekanmbi [2], Adeola Fowotade [3], Akindele Adebiyi [4], Adekunle Adeniji [5], Olukemi Amodu [6], E. Oluwabunmi Olapade-Olaopa [7]

Author affiliations

1. Radiation Oncology Department, College of Medicine, University of Ibadan
2. Department of Medicine, College of Medicine, University of Ibadan
3. Department of Medical Microbiology and Parasitology, College of Medicine, University of Ibadan
4. Department of Community Medicine, College of Medicine, University of Ibadan
5. Department of Virology, College of Medicine, University of Ibadan
6. Institute of Child Health, College of Medicine, University of Ibadan
7. Office of the Provost, College of Medicine, University of Ibadan

Correspondence: akin2nde@gmail.com

ABSTRACT

The novel COVID-19 pandemic prompted an unprecedented Institutional reaction to aggregate existing capacity from silos of research laboratories to establish a multidisciplinary research laboratory for COVID19 testing. In less than two weeks, resources were mobilized from the community to strengthen public health response and epidemic control. Such strengthening of institutional research capacity to support public health response contributes to a natural knowledge transfer, facilitates collaboration, and generates new frontiers for knowledge production that should ultimately lead to professional development and retention of skilled human resources. This report describes the pre-established mechanisms and involvement of the authors that made it possible to set-up a multidisciplinary laboratory in a remarkably short period of time. We also discuss the opportunities and sustainability of multidisciplinary laboratory research post-COVID19. Existing institutional capacity can be repurposed to establish multidisciplinary research laboratories to support the strengthening of basic and clinical translational research capacity in resource limited settings and impact on public health and scientific knowledge for socioeconomic development.

Keywords: COVID19, sub-Sahara Africa, PCR testing, Capacity building

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Background

Core facilities are multidisciplinary research laboratories that provide sophisticated equipment and expertise to support scientists who share inter-disciplinary research interests. Core facilities require several supporting services such as biorepositories, bioinformatics, and a production unit to provide consumables like culture media, buffers, and services such as autoclave and glass-wash, dry ice and liquid nitrogen production, that support routine research activities. These services may be outsourced or shared with a regional facility nearby. More advanced core facilities may require biosafety level designation and strict compliance with international good laboratory practices as routine aspects of their creation. The constant threat of emerging and re-emerging infectious pathogens underscores the need for strengthening institutional capacity in terms of establishing core facilities for biotechnology research.

Disparities in core laboratory Infrastructure, funding, and expertise for Health in Developing Countries

Developing countries bear a disproportionately high burden of infectious diseases, and endemic epidemics are not uncommon [1]. In developing countries, it is not unusual to transport biospecimens from field sites to regional or overseas institutions for basic science laboratory studies[1]. This serves an important need but preserves the important challenge of shifting scientific capital away from areas of low capacity. Advanced technical projects in population data, bio-epidemiology and molecular research capabilities in Nigeria have been accomplished but still fall short of the needs for population-based, site-focused research needs[2]. Since molecular biology research laboratory tools are seldom needed for routine clinical diagnostic use, it is pragmatic and cost-effective to shutdown “project based” field sites post event. However, regional sites retain the important function of surveillance and research that contribute to the development of solutions for improving health during and after the outbreak [1]. Typically, regional core facilities make it easy to attain otherwise impossible goals, often in a timely and cost-effective manner, but are less flexible when responding to complex problems. Thus, developing countries lag in the design and

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application of basic molecular sciences (molecular biology, genomics and biotechnology) to support health research and service delivery. This is related to the lack of core laboratories at the institutional level, and a poor culture of inter-disciplinary collaboration in developing countries, which translates into poor knowledge production, as well as poor publication and citation indices for biomedical research [2].

A new Institutional Capacity Standard for Developing Countries

The College of Medicine, University of Ibadan (COMUI) successfully incorporated a COVID19 testing laboratory into its existing core laboratory and biorepository building to facilitate the much-needed biotechnology support for clinical case management. COMUI, is among the leading Medical Schools in sub-Saharan Africa that has a strong tradition for excellence and vast experience in research and human capacity development to serve the Nigerian population exclusively. This was demonstrated by the remarkable speed with which the multidisciplinary laboratory was incorporated to respond to community needs. Strengthening our core laboratory generated value by establishing stronger partnerships across disciplines and repurposing otherwise latent infrastructure and human resource capacity. The collective experiences from past transnational collaborations by the authors[3–8], culminated in the vision to establish the COVID19 laboratory and its unprecedented execution in two weeks. The laboratory is now an accredited COVID19 testing site under the Nigeria Center for Disease Control (NCDC) Network.

Our now clear understanding of strengthening institutional capacity for core laboratories was not without challenges. The set-up cost required a back-up generator for reliable electricity supply and maintenance of cold storage for biobanking, planning for biowaste management systems and ad-hoc logistics for supply of equipment and consumables during a lockdown. The empty building required extensive repairs and upgrades of the mechanical and electrical works to match the high-quality materials for sensitive laboratory equipment. The often-cited issues of underfunding of health and education were mitigated by exploring non-traditional funding sources. Alumni and friends of the College sacrificially donated funds to support our proposal while staff brought together equipment from the individual laboratories. COVID19 served as

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a unifying initiative to engage researchers from diverse backgrounds and research interests. The initial negotiation did not entertain the challenges that lay ahead in terms of stakeholder engagement and branding the laboratory as a clinical virology laboratory. Evidently, the ability to acclimate to new ways of thinking, brutal flexibility and purposeful collaboration has become the new baseline for survival. Thus, scientists, government, and policy makers are learning to communicate more, have a better understanding of how to work with scientists in different fields and how to coordinate with industry. When deployed appropriately, core laboratories provide a tremendous return on investment and foster innovation and development[9].

Critical elements for success

By design, most medical schools are geographically near their teaching hospitals and are often indistinguishable and intertwined in the clinical domain but administratively distinct. Siting the core laboratory building in proximity to the clinical care domain was one of the enabling factors. Although COMUI and the University College Hospital (UCH) Ibadan are the leading Medical School and Postgraduate Medical Training Institution in the country, the number of individuals with skills and knowledge in the molecular sciences' methods are few. Thus, strengthening basic molecular research capacity at the individual and institutional level is an essential strategy for raising the standard of medical research, education, and consequently patient care.

The pre-existing mechanisms for coordination of initiatives, communication and fundraising already in place at the College of Medicine was another critical element for success. To mention a few, the template for successful engagement with Industry made it easy to communicate our needs in a way that Industry could respond to; it focussed on the value created and the metrics of evaluating such impact. Second was the multidisciplinary approach of the intervention in terms of inter-disciplinary resources and the cross-trained scientists who combine biotechnology with other sciences including basic and clinical sciences. The integration of these was pivotal to the COVID19 public health response. The critical importance of interdependence of multidisciplinary teams sets apart core facilities from other laboratory set-ups. Capacity

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building of research infrastructure in low resource settings has the potential to foster lower running costs and ubiquitous development of the molecular sciences in Africa.

Existing Gaps

One critical need for core laboratories is access to a Biorepository. The main purpose of a Biorepository is to collect, store, process biospecimens for diagnosis and serves as a biobank for continuous research and clinical studies. Biorepositories also serve as a memory bank for providing data arising from previous break outs or epidemics of re-emerging diseases, thus providing a mainstay or support for prospective and future research questions, ideas, or studies. There is still an urgent need for developing and sustaining a Biorepository that can study, research, predict health events, collect, and effectively handle population data in the face of health epidemics, and also innovate solutions and develop human capacity.

Despite modest and increasing availability of skilled scientists, local access to high-quality teaching of molecular sciences and biotechnology sciences is lacking. Opportunities to strengthen curriculum and increase the numbers of local postgraduate enrolments for the molecular sciences are needed. There is also the overarching need for mentoring and community leadership skills [4]. This helps students, scientists, and administrators to develop a familiarity for research ethics and orientation to regulatory procedures governing molecular sciences research. This also fosters broad principles of effective cross-cultural communication, team building and collective reasoning and global collaboration.

Conclusion

Repurposing existing capacity into central multidisciplinary facilities is timely, useful and challenging. There is a clear link between the extent of technical details and funding required for basic science and the education and training gaps in low resource settings. Urgent steps to increase the range of molecular sciences research skills at the level of the individual and institution are required. Recognizing the institutional strengths or core research focus is key to initiating capacity development and designing

appropriate equipment and supporting services for setting up core facilities for molecular sciences research in health. Non-traditional funding, local and global collaborations and partnership with industry are viable contexts to develop capacity for health-related molecular sciences research in developing countries and should be explored. However, grant mechanisms for this basic science capacity building in Africa are desired.

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Graphical Abstract